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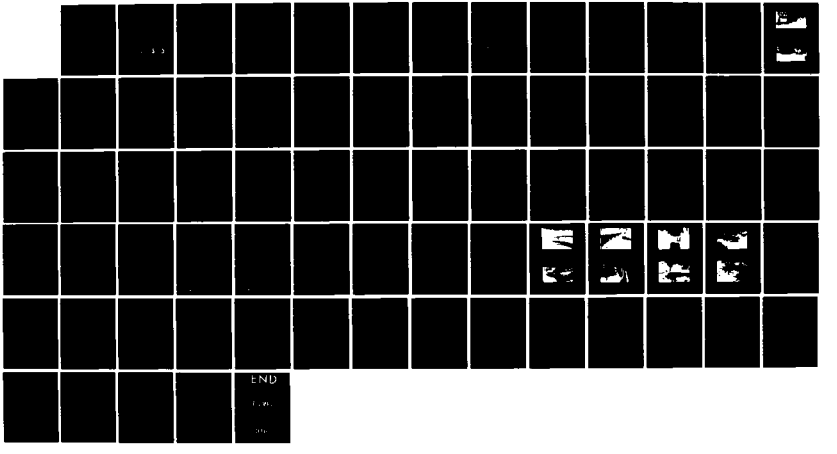
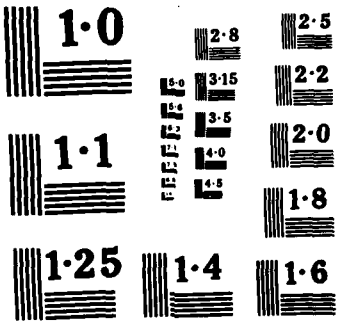


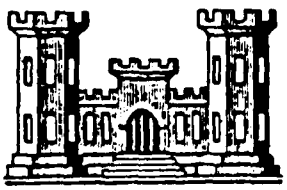


NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

CHARLES RIVER BASIN
NEEDHAM, MASSACHUSETTS

ROSEMARY LAKE DAM
MA 01112

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JANUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Charles River Basin
Needham, Massachusetts
Rosemary Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth embankment about 440 ft. long with a top width of about 50 ft. The dam is small in size with a hazard potential of high. The dam appears to be in fair condition. There are various operation and maintenance measures that the owner should undertake.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

MAY 30 1980

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Rosemary Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, the town of Needham, Massachusetts.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

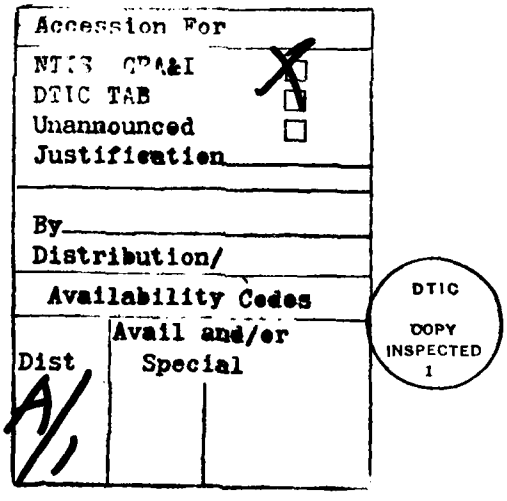
Incl
As stated

ROSEMARY LAKE DAM

MA 01112

CHARLES RIVER BASIN

NEEDHAM, MASSACHUSETTS



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	MA 01112
Name of Dam:	Rosemary Lake Dam
Town:	Needham
County and State:	Norfolk, Massachusetts
Stream:	Rosemary Brook
Date of Inspection:	October 16, 1979

BRIEF ASSESSMENT

Rosemary Lake Dam is an earth embankment approximately 440 feet long with a top width of about 50 feet. The upstream face of the dam is a stone parapet wall and the downstream slope of the embankment which is the lawn of an apartment complex is an estimated 20H:1V. The service and auxiliary spillways are both drop-inlet structures which discharge into two 66-inch diameter conduits; however, the conduits are 48-inch diameter at their downstream outlets. The dam once furnished the water needs of a mill located at the damsite; however, the impounded waters are now used for recreational purposes by the Town of Needham.

The lake behind the dam is about 1,100 feet long and has a surface area at the spillway crest level of about 15 acres. The drainage area above the dam is 1.2 sq. miles and the maximum storage at the top of the dam is about 91 acre-feet. The height of the dam is approximately 12 feet; therefore the size classification is "Small." A breach of the dam would have a critical effect on the 210 unit apartment complex built immediately downstream of the dam as well as having an impact on an elementary school 1,700 feet downstream and seven homes 3,700 feet downstream. The dam has been classified as having a "High" hazard potential. Based on the "Small" size and "High" hazard potential, the range for the test flood is one-half of the Probable Maximum Flood (PMF) to the full PMF. The selected test flood for the project is one-half of the PMF based on the dam height, storage capacity and downstream flood impact area.

The dam appears to be in fair condition. The upstream stone parapet wall appears to be aligned properly and there were no signs of depressions, seepage or other deficiencies observed along the crest and downstream slope of the embankment. About 5 gpm seepage was noted entering a storm sewer on the upstream side of the dam along Rosemary Street.

The test flood peak inflow for the facility was computed as 1,020 cfs. The routed test flood outflow is also 1,020 cfs which results in the dam being overtopped

by 0.7 feet. The spillway system can pass 247 cfs or about 24 percent of the routed test flood outflow without overtopping of the dam.

Within one year after receipt of this Phase I Inspection Report, the Owner, the Town of Needham, should retain the services of a qualified registered professional engineer and implement the results of his evaluation of the following: (1) assess further the potential for overtopping and the adequacy of the spillways; (2) study the cause of the seepage to the storm sewer located under Rosemary Street; (3) investigate the seismic stability of the dam.

The Owner should also implement the following operation and maintenance measures: (1) clear obstructions from the channel downstream of the spillway conduits; (2) verify the operability of the low level drain gate valve; (3) repair or replace the grating on the auxiliary spillway inlet structure; (4) develop a formal surveillance and flood warning plan, including round-the-clock monitoring during heavy precipitation; and (5) institute a program of annual technical inspection.

O'BRIEN & GERE ENGINEERS, INC.

John J. Williams
Vice President
New York Registration No. 050794

Date 22 FEB. 80

This Phase I Inspection Report on Rosemary Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of theses guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

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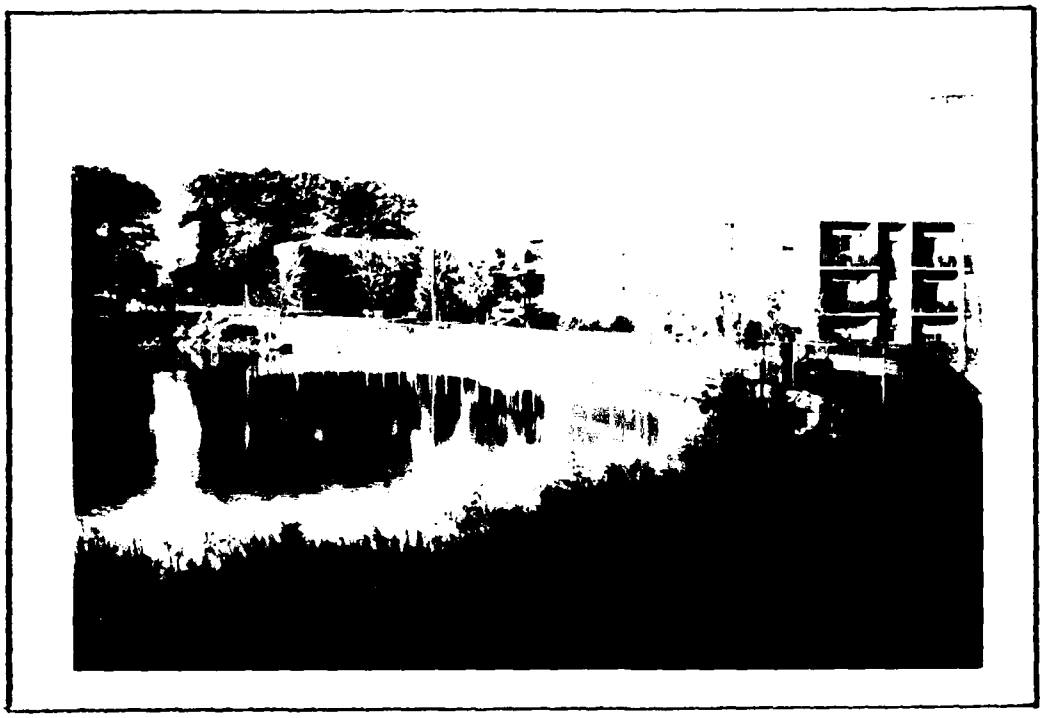
APPENDICES



OVERVIEW OF THE UPSTREAM FACE OF ROSEMARY LAKE DAM. (10/16/79)

OVERVIEW OF THE DOWNSTREAM FACE OF ROSEMARY LAKE DAM. (10/16/79)

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

At the time of inspection, the dam showed no visible signs of instability. The stone parapet wall at the upstream face of the dam appears to be sound and there is no significant evidence of pavement deterioration on Rosemary Street. The downstream slope also appears to be in good condition and is well maintained.

6.2 Design and Construction Data

There is no known design and construction data available for the original dam or for any subsequent modifications.

6.3 Post Construction Changes

The only known modifications of the original dam construction consist of the following:

a. Reconstruction of the stone masonry parapet wall along the upstream face of the dam in 1933.

b. Plugging of the inlet to the race serving the former Tillotson Rubber Company (date unknown).

c. Paving and repaving of Rosemary Street on the dam crest (dates unknown).

d. Construction of the apartment complex just to the north of Rosemary Street with subsequent lawn construction which modified the downstream slope of the dam (approximate date, 1974).

e. It appears that the 66-inch diameter outlet conduits from the service and auxiliary spillways were extended with 48-inch diameter reinforced concrete pipe at the same time the apartment complex was constructed.

6.4 Seismic Stability

Rosemary Lake Dam is located in Seismic Zone 3 of the "Seismic Zone Map of Contiguous States." Considering its "High" hazard classification, a seismic stability investigation should be conducted as recommended in Section 7.

The peak inflow and routed outflow for the test flood were both calculated to be 1,020 cfs. The routed test flood outflow corresponds to a stage of 3.4 feet above the service spillway crest and 0.7 feet above the top of the dam. The combined spillway capacity without overtopping the dam was calculated to be 247 cfs which is about 24 percent of the routed test flood outflow.

5.5 Dam Failure Analysis

A failure of the embankment was simulated by the HEC-1-DB computer program assuming a 44-foot wide and 8.7-foot deep breach with vertical side slopes developing within one hour. The failure is assumed to occur with the reservoir surface at the top of dam elevation. The resulting outflow was routed to the 210-unit apartment complex located approximately 150 feet downstream of the dam. The increase in stream depth at this point was computed to be 7.2 feet. About 1,700 feet downstream, in the vicinity of an elementary school, the increase in stream depth is about 5.3 feet and about 3,700 feet downstream, in the vicinity of 7 homes, the increase in stream depth is about 6.6 feet.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Rosemary Lake Dam has a watershed about 1.2 miles long and 1.0 miles wide. The drainage area lies almost entirely within the Town of Needham which is developed residentially, commercially and industrially. The topography is hilly ranging from Elev. 250 to Elev. 99 at the damsite. Rosemary Brook approaches the reservoir from the west and south adjacent to the basin divide. The watercourse meanders excessively through the basin.

5.2 Design Data

Neither hydraulic nor hydrologic design data is available for Rosemary Lake Dam.

5.3 Experience Data

No records of high reservoir pools or dam overtoppings are available for this site.

5.4 Test Flood Analysis

Based on the "Small" size and "High" hazard potential, the range for the test flood is one-half of the Probable Maximum Flood (PMF) to the full PMF. The selected test flood is one-half of the PMF based on the relatively small storage capacity and the resistance to breaching due to the extremely flat downstream slope. Hydrologic and hydraulic calculations were performed with the assistance of the HEC-1-DB computer program. The flood hydrographs were constructed from the Snyder unit hydrographs using average coefficients, an initial infiltration of zero, and a constant loss rate of 0.05 inches per hour. The Hop Brook Adjustment Factor was used to reduce the Probable Maximum Precipitation based on the drainage area. Stage vs. Discharge and Stage vs. Storage relationships above the spillway crest were developed for Rosemary Lake Dam. Since both the service and auxiliary spillways discharge into underground conduits, calculations were performed using an orifice equation to approximate the capacity of the two conduits. The results indicate that the discharge capacities of both spillways are orifice controlled for all heads greater than two feet above the spillway crests. The impoundment was assumed to be at the service spillway crest at the beginning of the storm event. Because of the excessive meandering of the watercourse through the basin, the time of travel from the farthest point in the basin is longer than might be expected for a drainage area of this size. Therefore, the lag time is estimated to be about 3 hours for construction of the unit hydrograph.

SECTION 4

OPERATION AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The normal operational procedures consist of opening the auxiliary spillway sluice gate during periods of heavy precipitation and/or runoff and draining the lake each year in order to clean the adjacent swimming pool area prior to the start of the swimming season.

b. Description of Any Warning System in Effect. According to the Owner's representative, there is no formal warning system in effect. However, if a situation should arise where there would be a chance of the dam overtopping, the residents of the apartment complex immediately downstream of the dam would be notified by the Town of Needham personnel.

4.2 Maintenance Procedures

a. General. Rosemary Lake is maintained by the Parks and Recreation Department for recreation purposes. Consequently, personnel from that department would be involved in clearing debris from spillway inlets and performing other similar maintenance tasks. In general, however, any maintenance of the dam is performed through the Department of Public Works on an as needed basis.

b. Operating Facilities. Operation of the auxiliary spillway sluice gate is controlled through the office of Mr. Jack Marr, Town Engineer. Mr. Marr's office would be responsible for notifying the Department of Public Works if maintenance work would need to be performed on the gate or other dam facilities.

4.3 Evaluation

For the most part, it appears that the dam is adequately maintained and operated. There is no evidence of overtopping and the existing facilities, including appurtenant structures and downstream drainage ways, appear to be in good condition, except for the grating on the auxiliary spillway inlet structure which needs to be repaired or replaced.

The Owner's representative did not know if the low level gate valve a few feet to the left of the service spillway is operable.

e. Downstream Channel. The two discharge conduits from the service and auxiliary spillways terminate at a headwall approximately 300 feet north of the dam. A rectangular-shaped channel with masonry walls conveys the flow another 150 feet to the north and discharges it into a natural stream bed. The width of the channel varies from 13 feet at the headwall to approximately 9 feet at the point of discharge. The height varies within a range of 4 to 5 feet. The bottom of the discharge channel has a significant amount of debris consisting primarily of stones and tree branches. Approximately 50 feet downstream of the headwall, a single lane concrete bridge has been constructed across the channel. There is a cross-sectional flow area of about 47 square feet under the bridge.

The stream bed downstream of the discharge channel averages about 8 feet in width with 2H:1V side slopes. A small amount of vegetation lines the channel, but does not appear to restrict the flow significantly.

The apartment buildings on the left side of the brook could experience appreciable damage if runoff significantly exceeds the channel capacity.

3.2 Evaluation

The dam appears to be in fair condition. The stone masonry parapet wall is tilted slightly towards the lake and 3 tree stumps were observed along the parapet wall near the left abutment. About 5 gpm of persumed seepage was noted discharging from the Storm sewer on the south side of Rosemary Street.

The grating on the auxiliary spillway inlet structure needs to be repaired or replaced. The size elevation, alignment and operability of the low level drain located a few feet to the left of the service spillway should be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Rosemary Lake Dam was performed on October 16, 1979. At the time of inspection, the level of the lake was about 2 inches above the crest of the service spillway and approximately 8 inches below the crest of the auxiliary spillway. Underwater areas were not inspected.

Observations and comments made during the field inspection appear on a checklist included as Appendix A of this report.

b. Dam. The dam appears to be in fair condition. The stone masonry parapet wall, rebuilt in 1933, appears to be sound; however, it is tilted slightly towards the lake. In addition, 3 tree stumps were observed along the parapet wall near the left abutment as shown on page 2, Appendix C of this report.

Rosemary Street is located on the top of the dam and appears to be in good condition with only slight longitudinal pavement cracking. It was also noted that there was about 5 gpm of presumed seepage discharging from the storm sewer on the south side of Rosemary Street.

An apartment complex is located just downstream of the dam. In essence, the grassed lawn of the apartment complex forms the downstream slope of the embankment and appears to be very well maintained.

c. Appurtenant Structures. The service and auxiliary spillway inlets appear to be in good structural condition. The only apparent problem is with the bar grating over the auxiliary spillway which is in need of repair or replacement.

It was not possible to adequately assess the condition of the discharge conduits extending from the spillway inlets to the downstream channel. However, the outlets of the pipes are unobstructed and appear to be in good condition.

The valve for a low level drain is located a few feet to the left of the service spillway inlet structure. The size, elevation and alignment of this drain is unknown.

d. Reservoir Area. The slopes along the perimeter of the lake are well vegetated and appear to be stable and free from appreciable erosion. Except for the eastern bank of the lake, the slopes are very gradual.

Further information with regard to the accumulation of silt on the lake bottom was obtained from the Owner and is included in Appendix B of this report.

SECTION 2

ENGINEERING DATA

2.1 Design

No design information relative to the dam construction is available according to Mr. Gary Petrini, Chairman of the Rosemary Lake Reclamation and Building Committee.

2.2 Construction

There is no known information with regard to the construction of Rosemary Lake Dam. The only information available indicates that the stone masonry wall forming the upstream face of the dam was rebuilt in 1933.

2.3 Operation

According to the Town Engineer, Mr. Jack Marr, the sluice gate in the auxiliary spillway inlet chamber is used to draw down the reservoir in anticipation of heavy precipitation and/or runoff. The only other time the sluice gate is operated is when the lake is drained each year to facilitate cleaning of the adjacent swimming pool.

It is not known whether the low level gate valve located immediately to the left of the service spillway is operable.

2.4 Evaluation

a. Availability. All information made available was obtained from personnel of the Town of Needham.

b. Adequacy. Sufficient information was obtained during the field investigation and through conversations and material obtained from the Owner's representative for the purpose of conducting a Phase I dam evaluation.

c. Validity. It appears that the information obtained with regard to the dam's history and the plans obtained from the tax assessor's office are valid.

j. Regulating Outlets.

1. Low level sluice gate inside the auxiliary spillway inlet structure.

Invert Elev.	92.9
Size	2 feet wide by 3 feet high
Description	Sluice gate in upstream wall of auxiliary spillway inlet chamber.
Control Mechanism	Hand wheel

2. Low level drain to the left of the service spillway, the size, elevation and alignment is not known.

e. Storage. (Acre-Feet)

Normal Pool	45
Flood Control Pool	NA
Spillway Crest Pool	45
Top of Dam	91
Test Flood Pool	105

f. Reservoir Surface. (Acres)

Normal Pool	15
Flood Control Pool	NA
Spillway Crest	15
Top of Dam	20
Test Flood Pool	21

g. Dam Data.

Type	Earth embankment
Length	440 feet±
Height	12 feet±
Top Width	50 feet±
Side Slopes	20H:1V (downstream) vertical (upstream)
Zoning	Unknown
Impervious Core	Unknown
Cutoff	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Tunnel.

Not Applicable

i. Spillways.

Service Spillway

Type	Sharp-crested
Length of Weir	7 feet
Crest Elevation	99.1
Gates	NA
Upstream Channel	None
Downstream Channel	66-inch to 48-inch RCP

Auxiliary Spillway

Type	Sharp-crested
Length of Weir	18 feet
Crest Elevation	99.9
Gates	NA
Upstream Channel	None
Downstream Channel	66-inch to 48-inch RCP

2) Maximum Known Flood. There is no known flood data available for this site.

3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity is restricted to the sum of the capacities through the outlet conduits from the service and auxiliary spillways. Therefore, the total ungated spillway capacity with orifice control is 247 cfs with the reservoir surface at the top of dam Elevation of 101.7.

4) Ungated Spillway Capacity at Test Flood Elevation. The total spillway capacity is restricted to the flow through the outlet conduits. With a test flood Elevation of 102.4, the discharge capacity through the two spillways is estimated to be 330 cfs.

5) Gated Spillway Capacity at Normal Pool Elevation. Not Applicable.

6) Gated Spillway Capacity at Test Flood Elevation. Not applicable.

7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity with orifice control at test flood Elevation 102.4 is restricted to the capacity of the two discharge conduits, which was computed to be 330 cfs.

8) Total Project Discharge at Top of Dam. (See 3 above)

9) Total Project Discharge at Test Flood Elevation. The combined discharge capacity of the spillways and the flow over the dam at test flood Elevation 102.4, is 1,018 cfs.

c. Elevation. (Feet above NGVD)

Streambed at Toe of Dam	90 ±
Bottom of Cutoff	Unknown
Maximum Tailwater	95+
Recreation Pool	99
Full Flood Control Pool	NA
Spillway Crest (Service)	99
(Auxiliary)	99.9
Design Surcharge (Original Design)	Unknown
Top of Dam	101.7
Test Flood Design Surcharge	102.4

d. Reservoir Length. (Feet)

Normal Pool	1,100
Flood Control Pool	NA
Spillway Crest Pool	1,100
Top of Dam	1,400
Test Flood Pool	1,500

e. Ownership. The dam is owned by the Town of Needham, Massachusetts. The Town's Parks and Recreation Director, Mr. Richard Foot, is the Owner's representative. He may be contacted at 1471 Highland Avenue, Needham, Massachusetts, 02192, (617-444-5100).

f. Operator. The dam is operated by personnel from the office of the Town Engineer, Mr. Jack Marr, at 470 Dedham Avenue, Needham, Massachusetts, 02192, (617-444-5100, ext. 141).

g. Purpose of Dam. The dam was originally constructed to impound water for the purpose of providing industrial water power. The impoundment is currently used for recreational purposes.

h. Design and Construction History. The design and construction history of the original dam, and for most of the subsequent modifications, is unknown. The only known reconstruction took place in 1933 when the stone masonry wall along the upstream face of the dam was rebuilt. No details of the wall reconstruction have been found.

i. Normal Operational Procedures. The normal operating procedures include:

1) Opening the auxiliary spillway sluice gate during periods of heavy precipitation and/or runoff.

2) Draining the lake each year in order to clean the adjacent swimming pool area prior to the start of the swimming season.

1.3 Pertinent Data

a. Drainage Area. The drainage area above Rosemary Lake Dam is 1.2 square miles. Nearly the entire area is developed for residential, commercial and industrial purposes. The topography is hilly ranging from Elev. 250 to Elev. 99 at the normal pool.

b. Discharge at Damsite.

1) Outlet Works. There are two conduits which convey discharge from Rosemary Lake. One reinforced concrete pipe, which measures 66 inches in diameter at the inlet and 48 inches in diameter at the outlet, extends approximately 300 feet northerly from the service spillway to a rectangular-shaped open channel. With the reservoir surface at the top of dam, the service spillway discharge capacity with orifice control is 92 cfs.

A second conduit extends from the auxiliary spillway to a headwall at the same discharge location as that for the service spillway conduit. It consists of a section of 66-inch diameter pipe which appears to have been extended with an unknown length of 48-inch diameter reinforced concrete pipe. Assuming the same conditions stated for the service spillway outlet, the auxiliary spillway discharge capacity with orifice control would be 155 cfs.

1) The upstream face of the dam consists of a vertical stone masonry wall of unknown depth.

2) The crest of the dam is almost completely covered with asphalt and concrete pavement due to the presence of Rosemary Street and an adjoining sidewalk. The total crest width is approximately 50 feet.

3) The downstream slope of the embankment consists of a gradually sloping grass lawn from the edge of Rosemary Street to an apartment complex.

The service spillway inlet is located approximately 120 feet west of the eastern dam abutment and consists of a 7-foot wide sharp-crested weir. Water overtopping the weir drops approximately 8.5 feet and flows approximately 300 feet in a northerly direction via a reinforced concrete pipe where it discharges into an open channel. The pipe is 66 inches in diameter in the inlet chamber, but is only 48 inches in diameter at the downstream outlet. The downstream channel is discussed in Section 3.1.e of this report.

The auxiliary spillway is located approximately 20 feet east of the main spillway as shown on Plate 1 of Appendix B. This spillway consists of a five-sided structure with a total overflow weir length of eighteen feet. Other features of the auxiliary spillway include:

1) A 2-foot by 3-foot low level sluice gate which may be used to assist in draining the lake.

2) A 36-inch diameter storm sewer draining to the inlet structure from the east. The contributing drainage area is not known.

3) An outlet pipe which extends approximately 300 feet in a northerly direction to an open channel. The pipe is 66 inches in diameter in the inlet chamber, but only 48 inches in diameter at the downstream outlet.

An operator for the low level drain valve is located a few feet to the left of the service spillway. The size, elevation and alignment of this low level drain are unknown.

Further details of the spillway system are shown on pages B-1 and B-2 of Appendix B.

c. Size Classification. Rosemary Lake Dam has a maximum height of approximately 12 feet which places it in the "Small" size category because it is less than 40 feet high. It also falls into the "Small" size category for storage since its maximum storage capacity is about 91 acre-feet which is less than the 1,000 acre-foot upper limit for "Small" size dams. Therefore, Rosemary Lake Dam is in the "Small" size category.

d. Hazard Classification. Because of the presence of a 210-unit apartment complex within 150 feet downstream of the dam, it is likely that a dam failure would result in excessive property damage and probable loss of life. Therefore, the dam is considered a "High" hazard potential structure.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
ROSEMARY LAKE DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspections throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. O'Brien & Gere Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the Commonwealth of Massachusetts. Authorization and notice to proceed were issued to O'Brien & Gere Engineers, Inc. by a letter from the Corps of Engineers dated November 6, 1979 and signed by Col. William E. Hodgson, Jr. Contract No. DACW33-80-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection. The purpose of performing technical inspection and evaluation of non-federal dams is to:

1) *Identify conditions which threaten the public safety* and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to quickly initiate effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

1.2 Description of Project (Information for this dam was obtained from the Town of Needham)

a. Location. Rosemary Lake Dam is located along the northern shore of Rosemary Lake on Rosemary Brook in the Town of Needham, Masschusetts. The dam is shown on the "Newton, Massachusetts" USGS Quadrangle at coordinates N 42° 17.2' and W 71° 14.4'. A regional vicinity map of the Rosemary Lake area has been included as Figure 1, Page vi.

Rosemary Brook outlets into the Charles River approximately 3 miles downstream from Rosemary Lake Dam. The major damage center is a 210-unit apartment complex immediately downstream of the dam.

b. Description of Dam and Appurtenances. Rosemary Lake Dam is an earth embankment approximately 440 feet long with a maximum embankment height of about 12 feet. The dam has the following features:

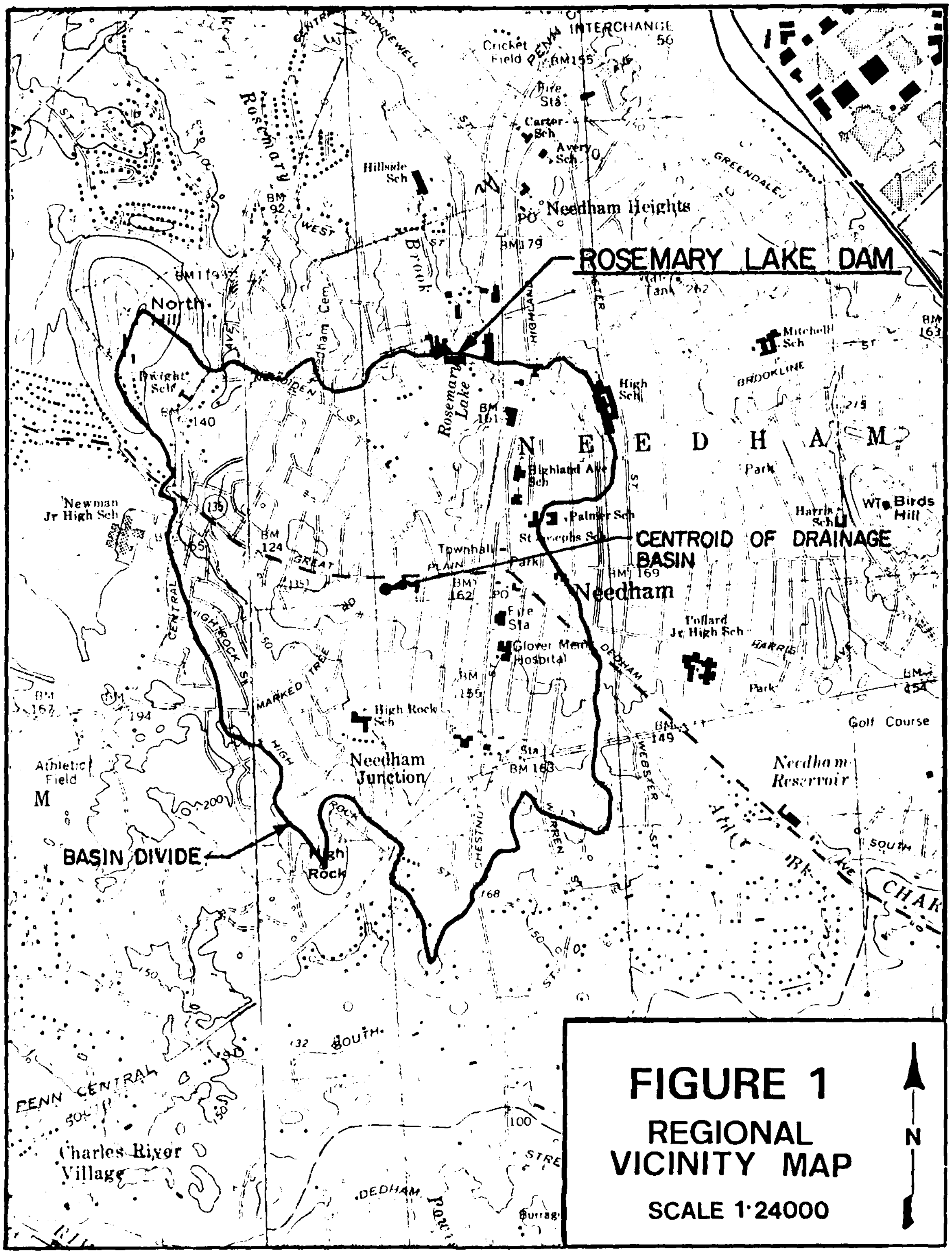


FIGURE 1

REGIONAL VICINITY MAP

SCALE 1:24000

SECTION 7

ASSESSMENT, RECOMMENDATIONS & PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The dam appears to be in fair condition based on the visual inspection of the site on October 16, 1979. The stone masonry parapet wall is tilted slightly towards the lake and 3 tree stumps were observed along the parapet wall near the left abutment. About 5 gpm of presumed seepage was noted discharging from the storm sewer on the south side of Rosemary Street.

The grating on the auxiliary spillway inlet structure needs to be repaired or replaced. The size, elevation, alignment and operability of the low level drain located a few feet to the left of the service spillway should be verified.

The peak inflow and routed outflow rates for the test flood were both calculated to be 1,020 cfs. The routed test flood outflow corresponds to a stage of 3.4 feet above the service spillway and 0.7 feet above the top of the dam. The spillway system is able to pass 247 cfs or about 24 percent of the routed test flood outflow without overtopping of the dam.

A breach of the dam with the water in the lake assumed to be at the top of the dam would result in an increase in stream depth at the apartment complex of 7.2 feet. About 1,700 feet downstream, in the vicinity of an elementary school, the increase in stream depth is about 5.3 feet and about 3,700 feet downstream, in the vicinity of 7 homes, the increase in stream depth is about 6.6 feet.

b. Adequacy of Information. The information made available by the Town combined with that obtained during the field investigation is considered adequate for a Phase I evaluation.

c. Urgency. The recommendations and remedial measures described in this Section should be implemented within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

Within one year afer receipt of this Phase I Report, the Owner, the Town of Needham, should retain the services of a qualified registered professional engineer and implement the results of his evaluation of the following:

1) Assess further the potential for overtopping and the adequacy of the spillways.

2) Study the cause of the seepage to the storm sewer located under Rosemary Street.

3) Investigate the seismic stability of the dam.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The Owner should also implement the following operation and maintenance measures:

1. Clear obstructions from the channel downstream of the spillway conduits.

2. Verify the operability of the low level drain gate valve.

3. Repair or replace the grating on the auxiliary spillway inlet structure.

4. Develop a formal surveillance and flood warning plan, including round-the-clock monitoring during heavy precipitation.

5. Institute a program of annual technical inspection.

7.4 Alternatives

No valid alternatives to the recommendations described above are considered feasibile for this dam.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

INSPECTION TEAM ORGANIZATION

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Location: Needham, Ma.

Type of Dam: Earth Embankment

Inspection Date(s): October 16, 1979

Weather: Clear, Cool

Pool Elevation: _____ MSL

Inspection Team

Leonard Beck	O'Brien & Gere	Structures
Steve Snider	O'Brien & Gere	Foundations & Materials
Al Hanscom	O'Brien & Gere	Structures
Rod Georges	Bryant & Associates	Hydrology/Hyraulics

*Mr. John J. Williams, Vice-President, O'Brien & Gere has visited the site but not necessarily in conjunction with the inspection team.

Owner's Representative

Mr. Richard Foot; Parks & Recreation Director; Needham, Ma.

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Con't)	
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Seepage to storm sewer located along crest.
Piping or Boils	None observed
Foundation Drainage Features	NA
Toe Drains	NA
Instrumentation System	NA

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS - SERVICE SPILLWAY	
a. Approach Channel	
General Condition	Unknown, Submerged
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Unknown, Submerged
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	Corrugated Metal Weir
Spalling	Slight
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None observed
Drain Holes	None observed
c. Discharge Channel	
General Condition	Good, clear of major size debris.*

*See Note 1, next page.

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS - SERVICE SPILLWAY (Con't)	
Loose Rock Overhanging Channel	Insignificant
Trees Overhanging Channel	Few
Floor of Channel	Rough, much debris
Other Obstructions	Concrete channel width narrows downstream

Misc. Notes:

1.) Discharge over weir flows ~ 150 feet via a 66-inch to 48-inch culvert to rectangular shaped concrete channel.

2.) Suspected that 72-inch dia culvert was extended with 48-inch dia. RCP.

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS - AUX. SPILLWAY	
a. Approach Channel	
General Condition	Unknown, Submerged
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Unknown, Submerged
b. Weir and Training Walls	
General Condition of Concrete	Very Good
Rust or Staining	Grating over drop inlet is rusted.
Spalling	Slight
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Leakage @ Sluice Gate
Drain Holes	NA
c. Discharge Channel	
General Condition	66-inch to 48-inch dia. conduit - condition unknown. Channel condition is good.

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 31112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS - AUX. SPILLWAY (Con't)	
Loose Rock Overhanging Channel	Insignificant
Trees Overhanging Channel	Few
Floor of Channel	Rough, much debris
Other Obstructions	Concrete channel width narrows downstream

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE - SERVICE SPILLWAY	
a. Approach Channel	
Slope Conditions	Unknown, Submerged
Bottom Conditions	Unknown, Submerged
Rock Slides or Falls	None
Log Boom	NA
Debris	Negligible
Condition of Concrete Lining	NA
Drains or Weep Holes	NA
b. Intake Structure	
Condition of Concrete	Very Good
Stop Logs and Slots	None

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

National I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE - AUX. SPILLWAY	
a. Approach Channel	
Slope Conditions	Unknown, Submerged
Bottom Conditions	Unknown, Submerged
Rock Slides or Falls	None, Drop Inlet
Log Boom	NA
Debris	Slight
Condition of Concrete Lining	NA
Drains or Weep Holes	NA
b. Intake Structure	
Condition of Concrete	Very Good
Stop Logs and Slots	NA

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

ational I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
JTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Outlet conduit condition unknown. Channel good.
Rust or Staining	NA
Spalling	Slight
Erosion or Cavitation	None observed
Visible Reinforcing	None
Any Seepage or Efflorescence	None observed
Condition at Joints	Unknown
Drain Holes	None observed
Channel (d/s of concrete chan.)	Meandering, clear of major size debris
Loose Rock or Trees Overhanging Channel	Several trees
Condition of Discharge Channel	Fair

VISUAL INSPECTION CHECK LIST

Project: Rosemary Lake Dam

tional I.D. #: MA 01112

Date(s): October 16, 1979

AREA EVALUATED	CONDITIONS
ITLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Good @ overflow - condition of RCP unknown.
Rust or Staining on Concrete	Slight
Spalling	Slight
Erosion or Cavitation	None observed
Cracking	None observed
Alignment of Monoliths	NA
Alignment of Joints	Unknown
Numbering of Monoliths	NA

APPENDIX B

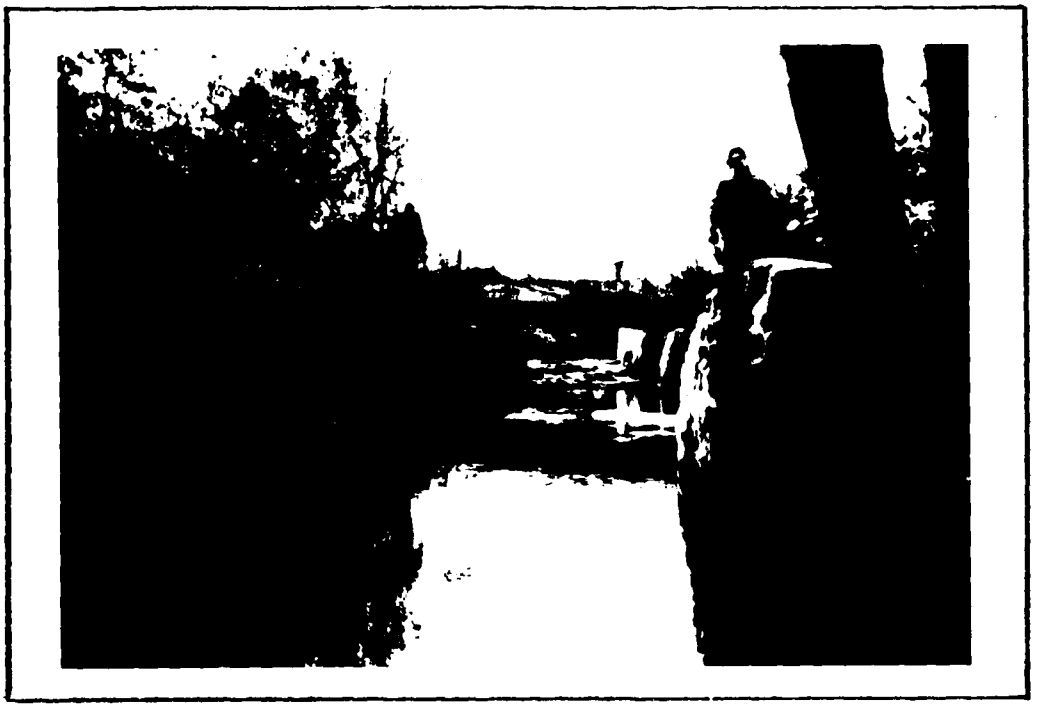
ENGINEERING DATA

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

7. CHANNEL ABOUT 2000 FEET DOWNSTREAM OF THE DAM WITH HILLSIDE ELEMENTARY SCHOOL IN THE BACKGROUND LOOKING DOWNSTREAM. (10/16/79)

8. CHANNEL ABOUT 4000 FEET DOWNSTREAM OF THE DAM AT CENTRAL AVE. (10/16/79)

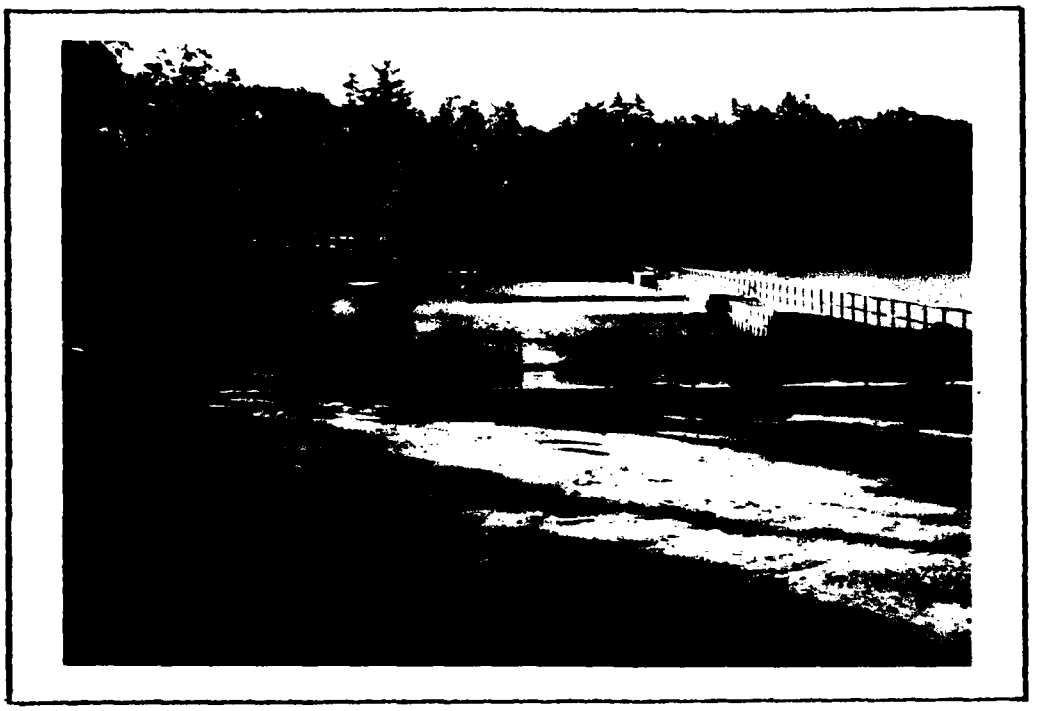


5. DOWNSTREAM CHANNEL ABOUT 500 FEET DOWNSTREAM OF THE DAM LOOKING UPSTREAM (10/16/79)

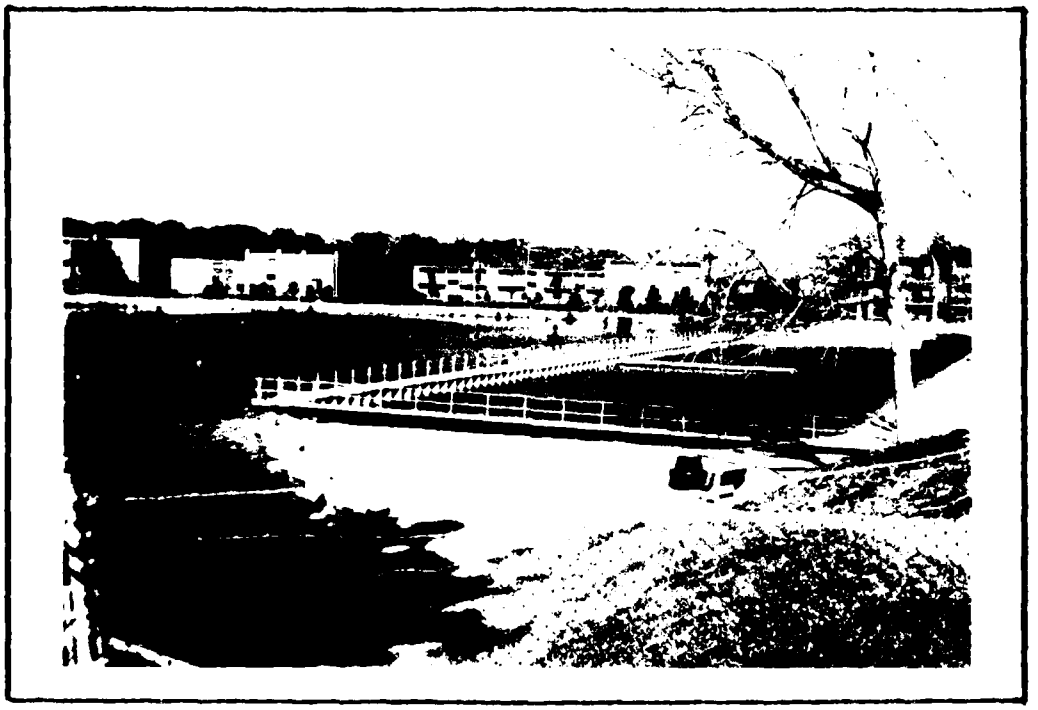
6. SEWERAGE PUMPING STATION ABOUT 2000 FEET DOWNSTREAM OF THE DAM ON THE LEFT BANK. (10/16/79)

3. UPSTREAM FACE OF THE DAM SHOWING CUT OFF TREES IN THE FOREGROUND. (10/16/79)

4. UPSTREAM FACE OF THE DAM SHOWING THE AUXILARY SPILLWAY IN THE FOREGROUND AND THE PRIMARY SPILLWAY IN THE BACKGROUND. (10/16/79)



1. MUNICIPAL SWIMMING POOL BUILT IMMEDIATELY NEXT TO ROSEMARY LAKE AT THE LEFT ABUTMENT. (10/16/79)



2. UPSTREAM OVERVIEW OF ROSEMARY LAKE. (10/16/79)

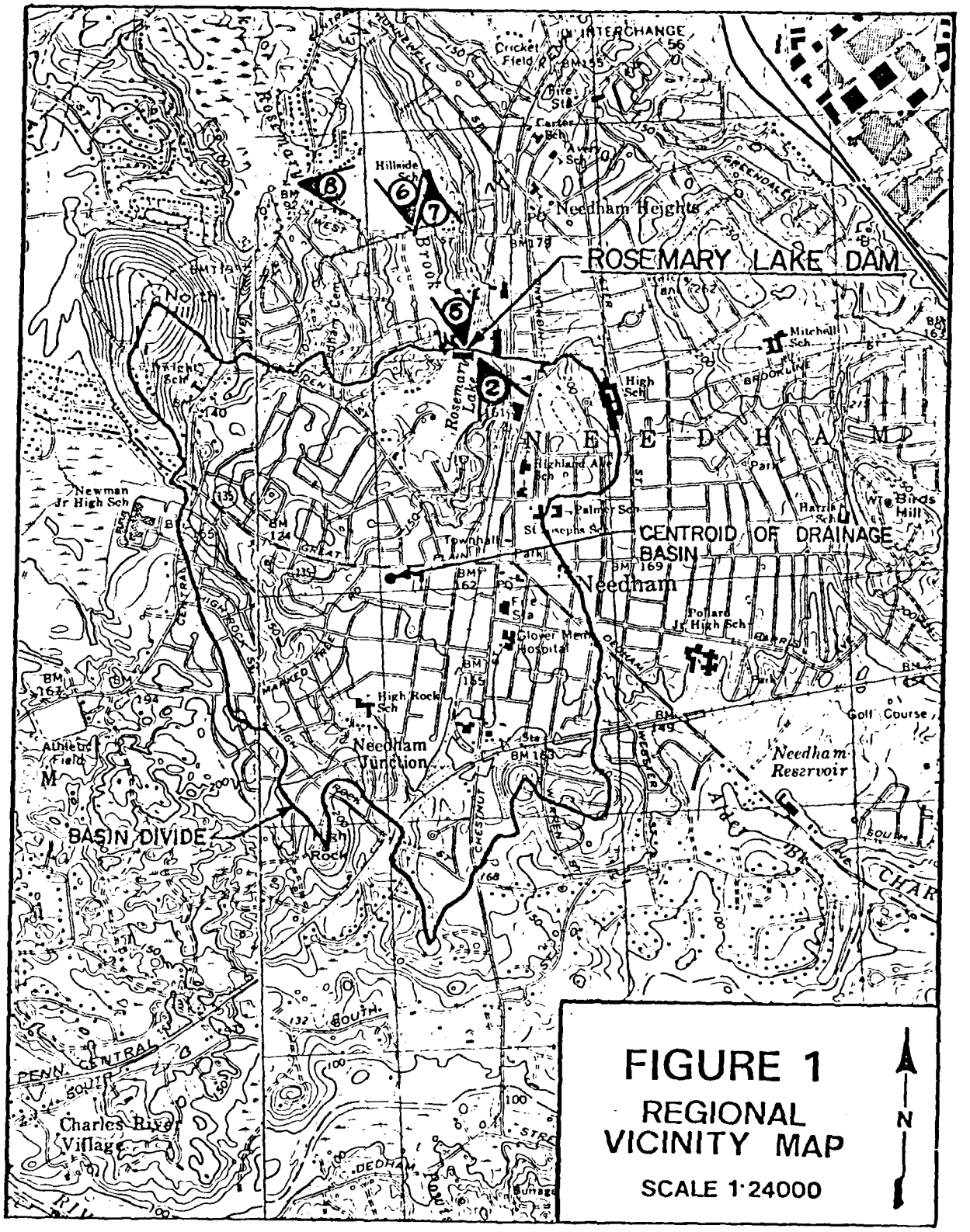


FIGURE 1

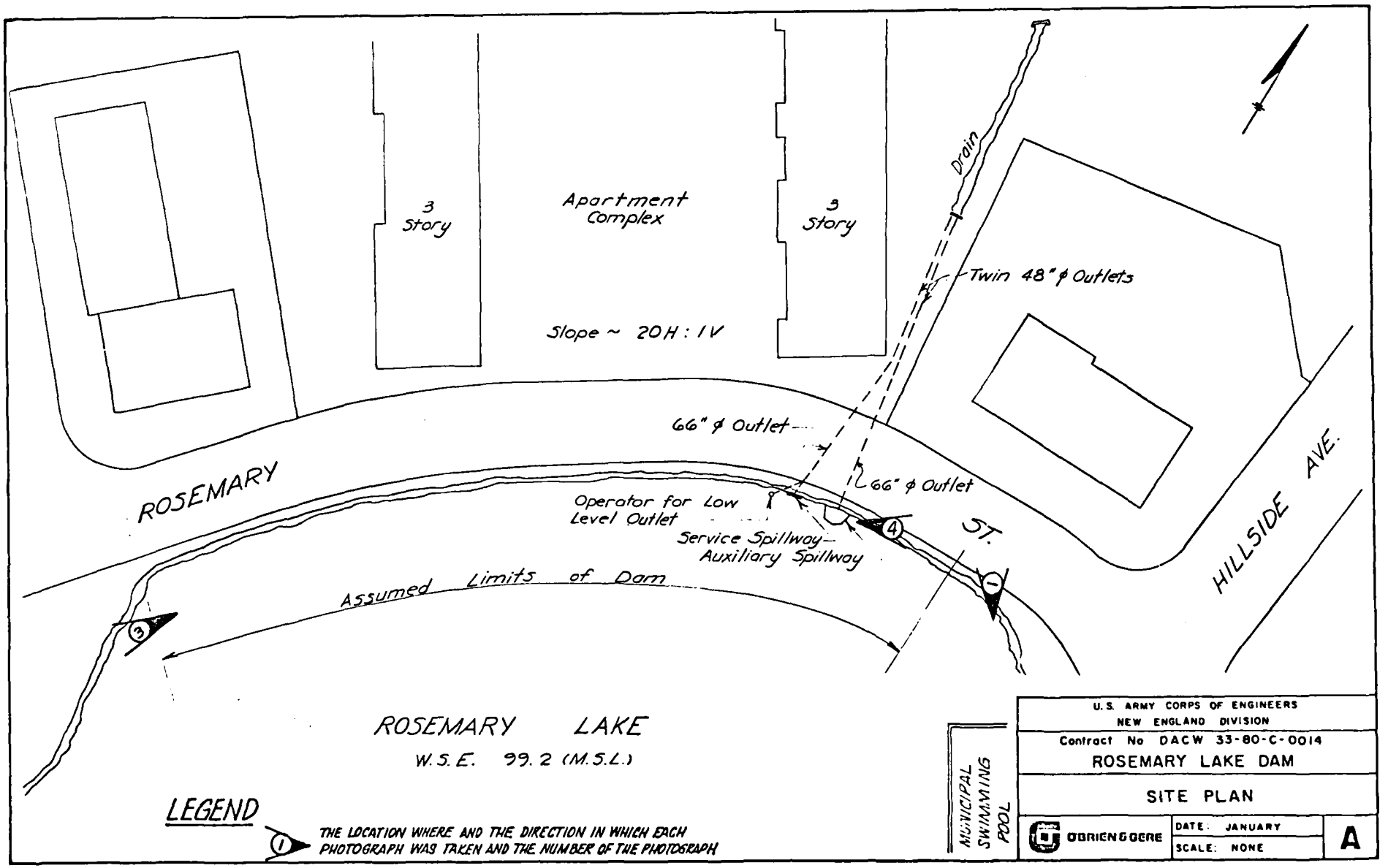
REGIONAL VICINITY MAP

SCALE 1:24000

LEGEND

(2) THE LOCATION AND DIRECTION IN WHICH EACH PHOTOGRAPH WAS TAKEN AND THE NUMBER OF THE PHOTOGRAPH

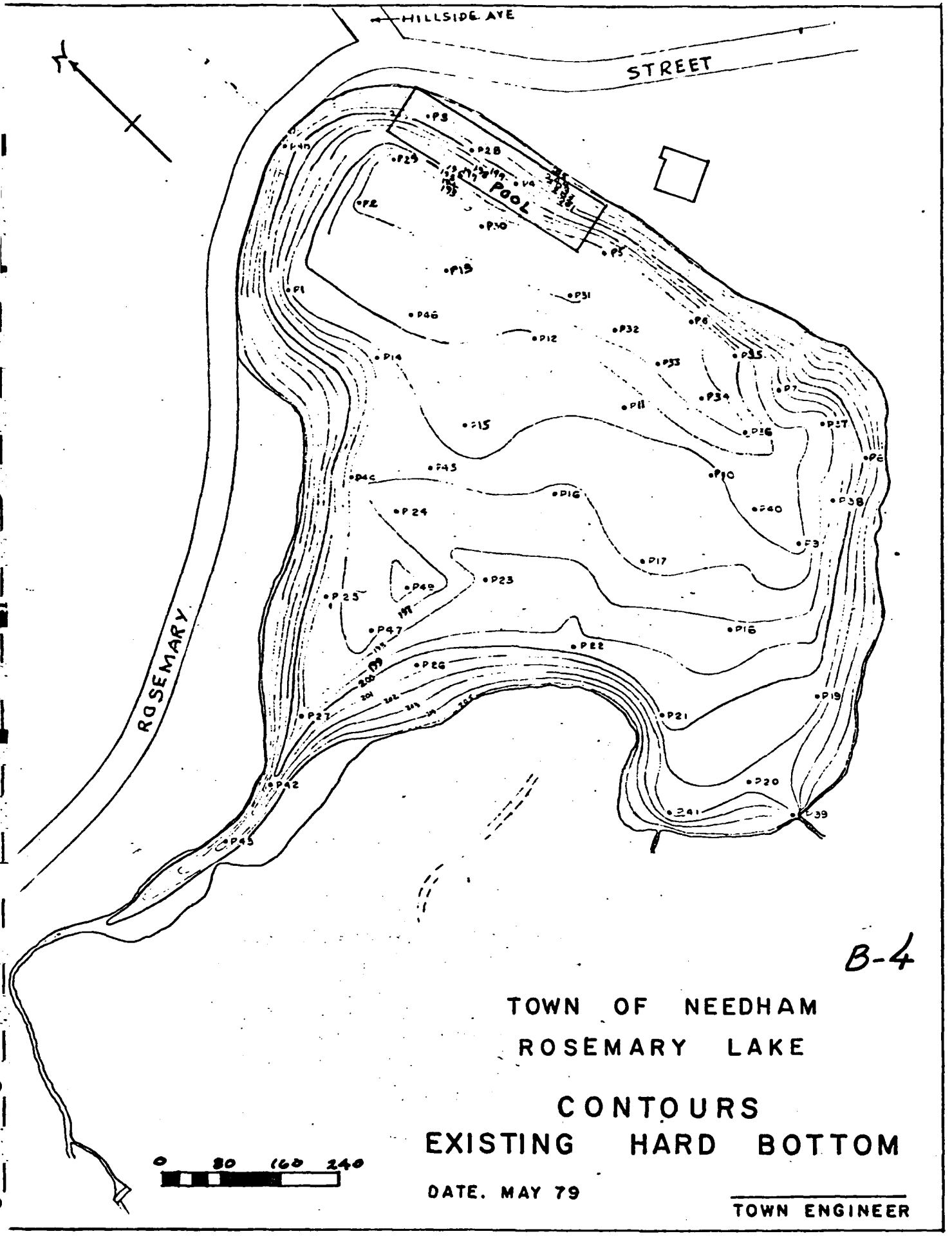
B


3 Story
Apartment Complex
3 Story
Drain
Twin 48" ϕ Outlets
Slope ~ 20H : 1V
66" ϕ Outlet
66" ϕ Outlet
ROSEMARY
Operator for Low Level Outlet
Service Spillway–Auxiliary Spillway
ST.
HILLSIDE AVE.
Assumed Limits of Dam
ROSEMARY LAKE
W.S.E. 99.2 (M.S.L.)
LEGEND
THE LOCATION WHERE AND THE DIRECTION IN WHICH EACH PHOTOGRAPH WAS TAKEN AND THE NUMBER OF THE PHOTOGRAPH
MUNICIPAL SWIMMING POOL
U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION
Contract No DACW 33-80-C-0014
ROSEMARY LAKE DAM
SITE PLAN
O'BRIEN & GERE
DATE: JANUARY
SCALE: NONE
A

APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT

APPENDIX C

PHOTOGRAPHS



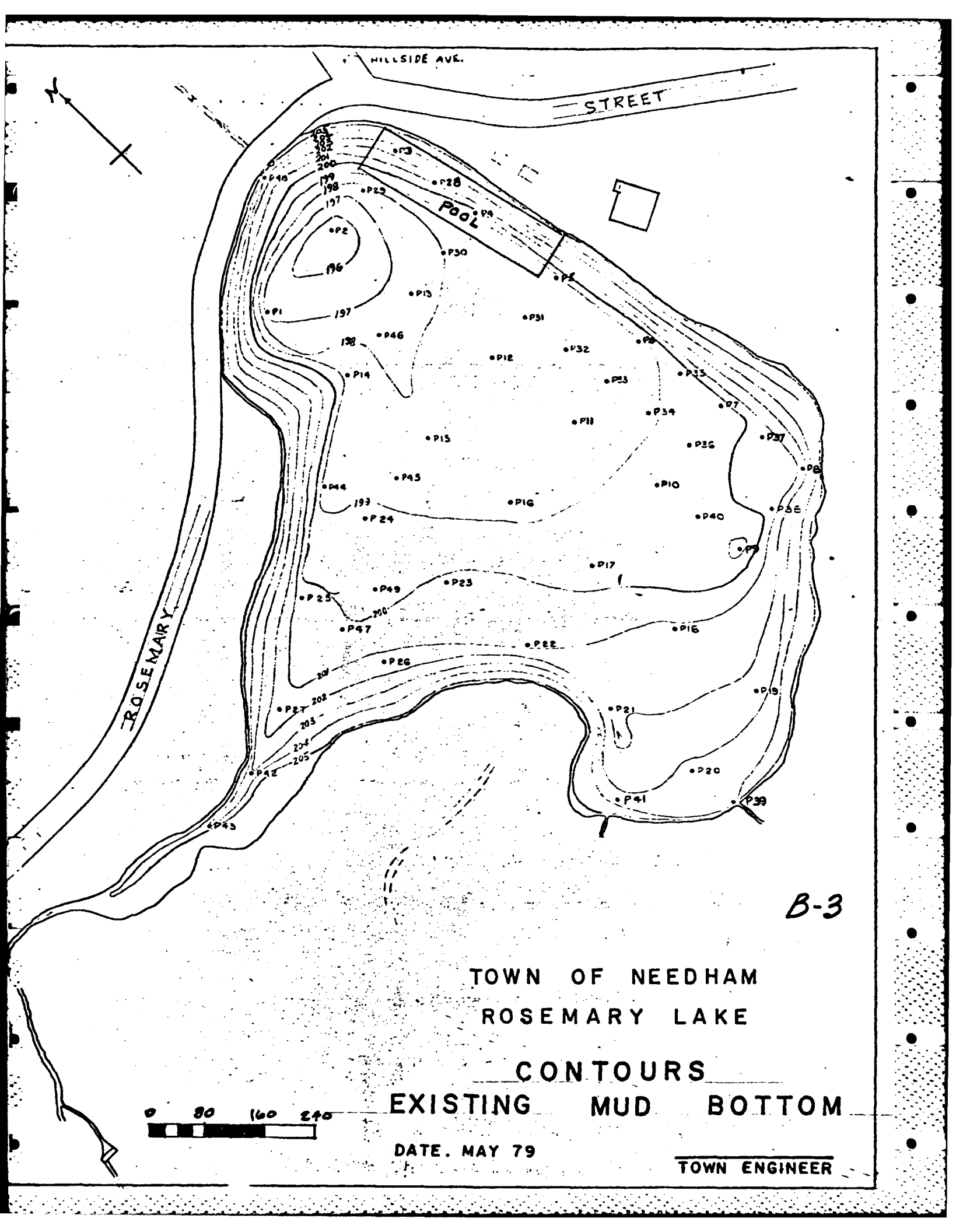
B-4

TOWN OF NEEDHAM
ROSEMARY LAKE

CONTOURS
EXISTING HARD BOTTOM

DATE. MAY 79

TOWN ENGINEER



B-3

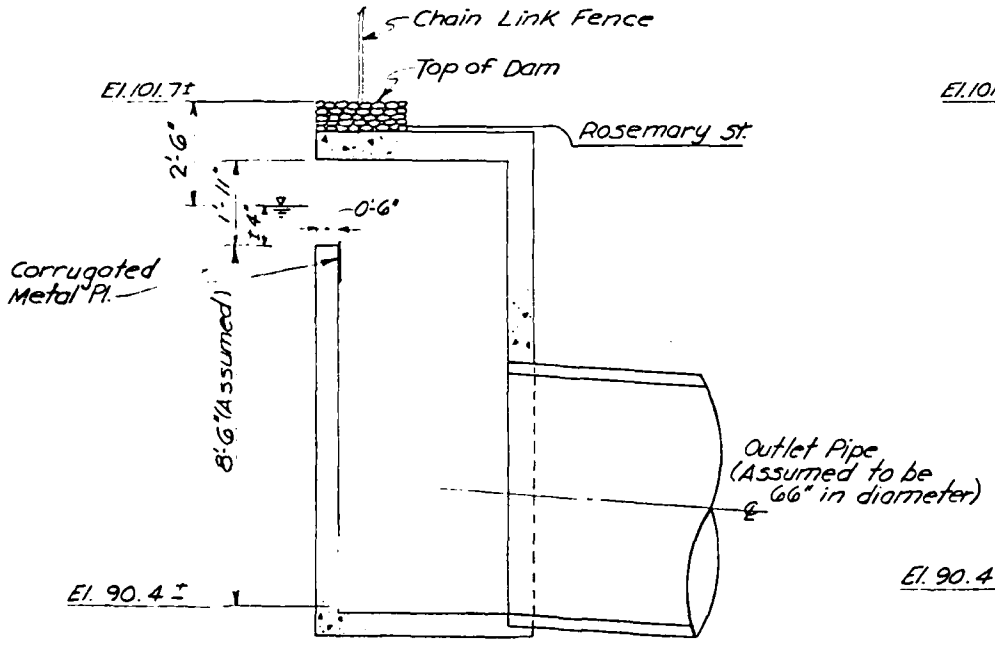
TOWN OF NEEDHAM
ROSEMARY LAKE
CONTOURS
EXISTING MUD BOTTOM

0 80 160 240

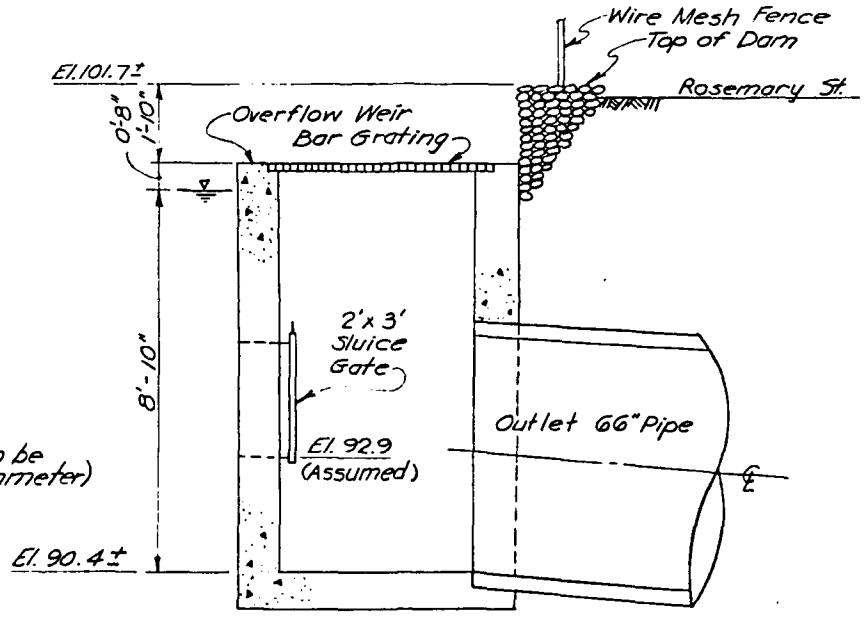
DATE. MAY 79

TOWN ENGINEER

Note:
All dimensions and elevations are approximate.

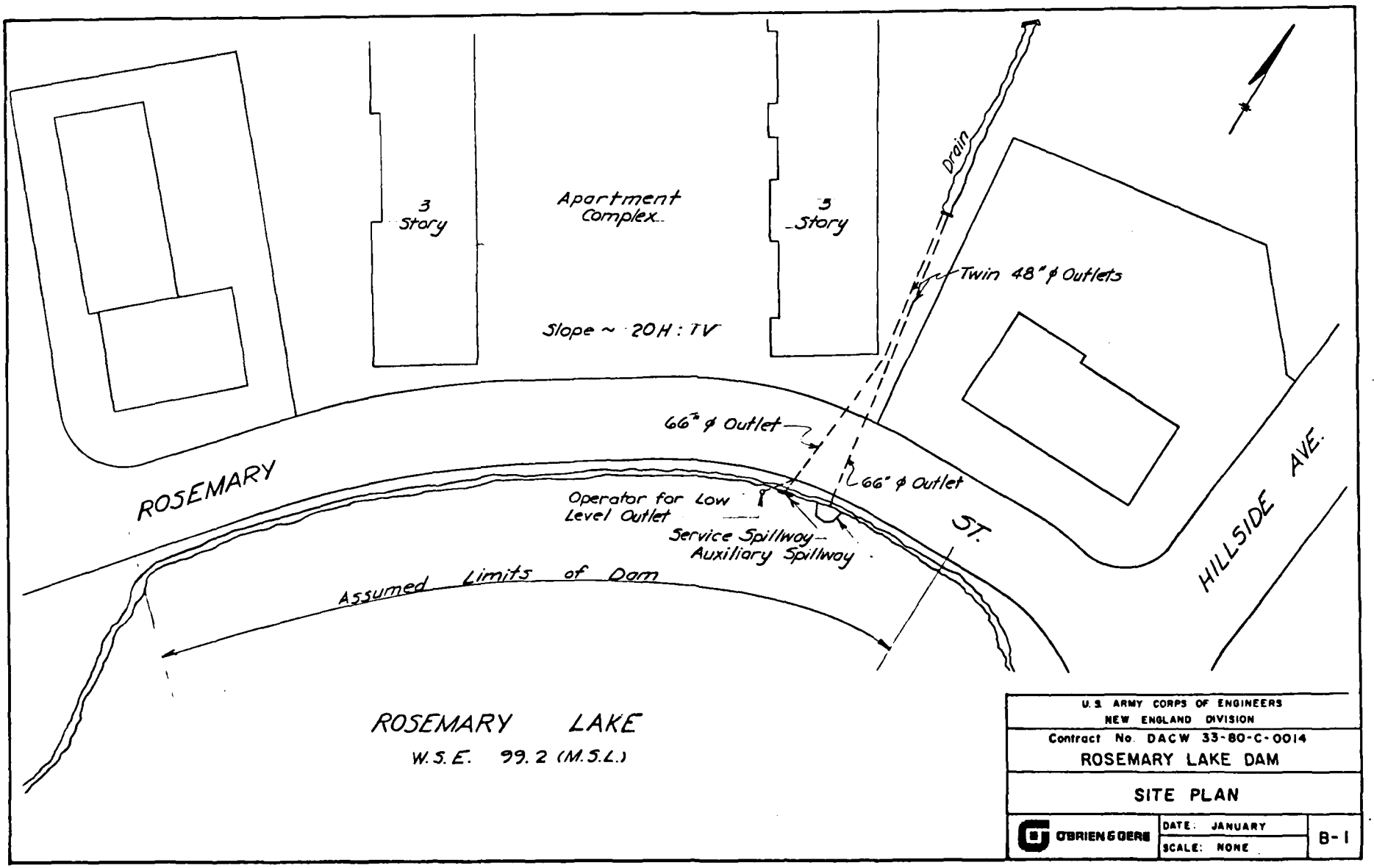


SERVICE SPILLWAY SECTION



AUXILIARY SPILLWAY SECTION

U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		
Contract No. DACW 33-80-C-0014		
ROSEMARY LAKE DAM		
SPILLWAY SECTIONS		
O'BRIEN & GERE	DATE: JANUARY 1980 SCALE: NONE	B-2



U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION

Contract No. DACW 33-80-C-0014

ROSEMARY LAKE DAM

SITE PLAN

O'BRIEN & GERE

DATE: JANUARY

SCALE: NONE

B-1

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
ROSEMARY LAKE DAM				

APPENDIX B

ENGINEERING DATA

TABLE of CONTENTS

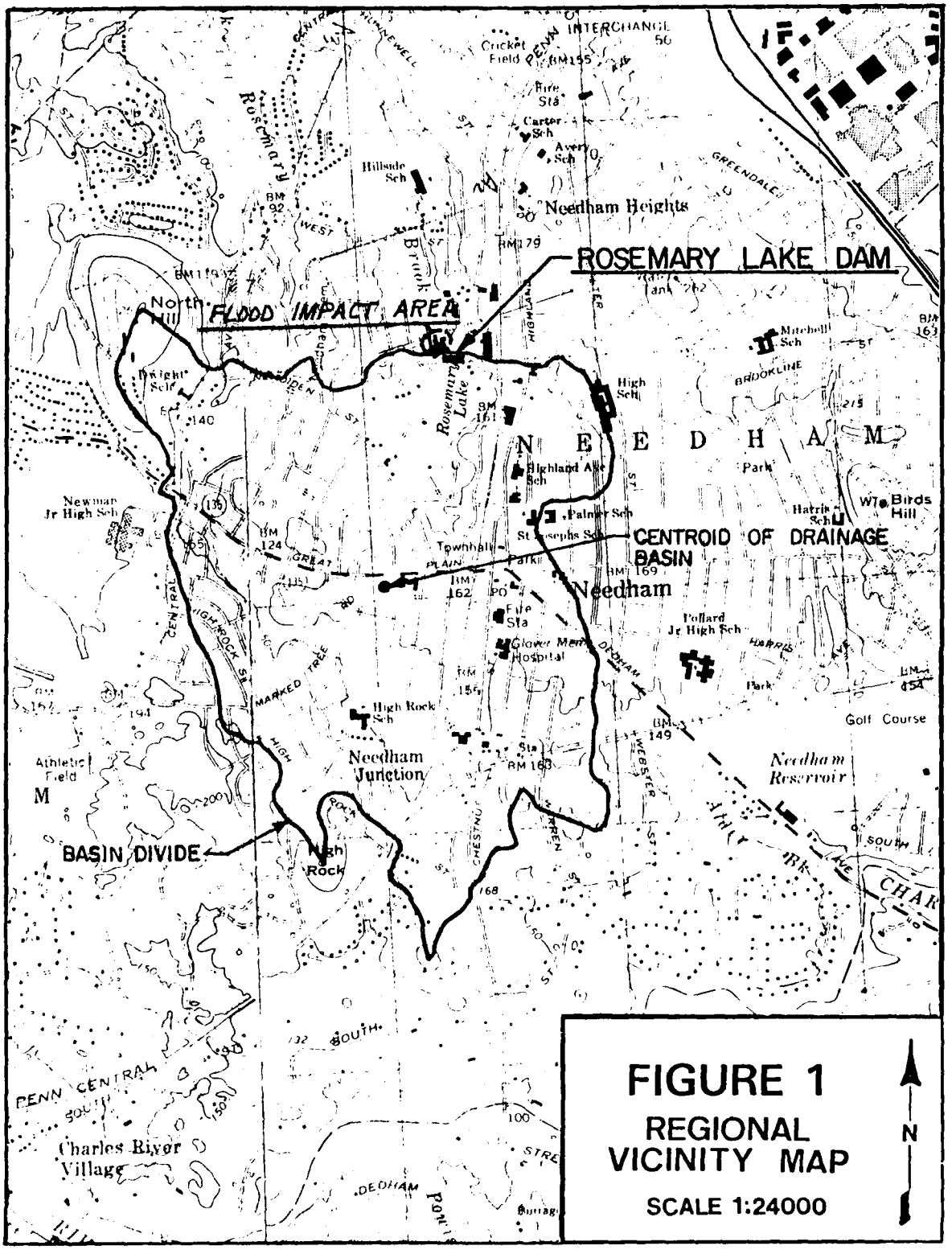
O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
ROSEMARY LAKE DAM				

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

TABLE OF CONTENTS

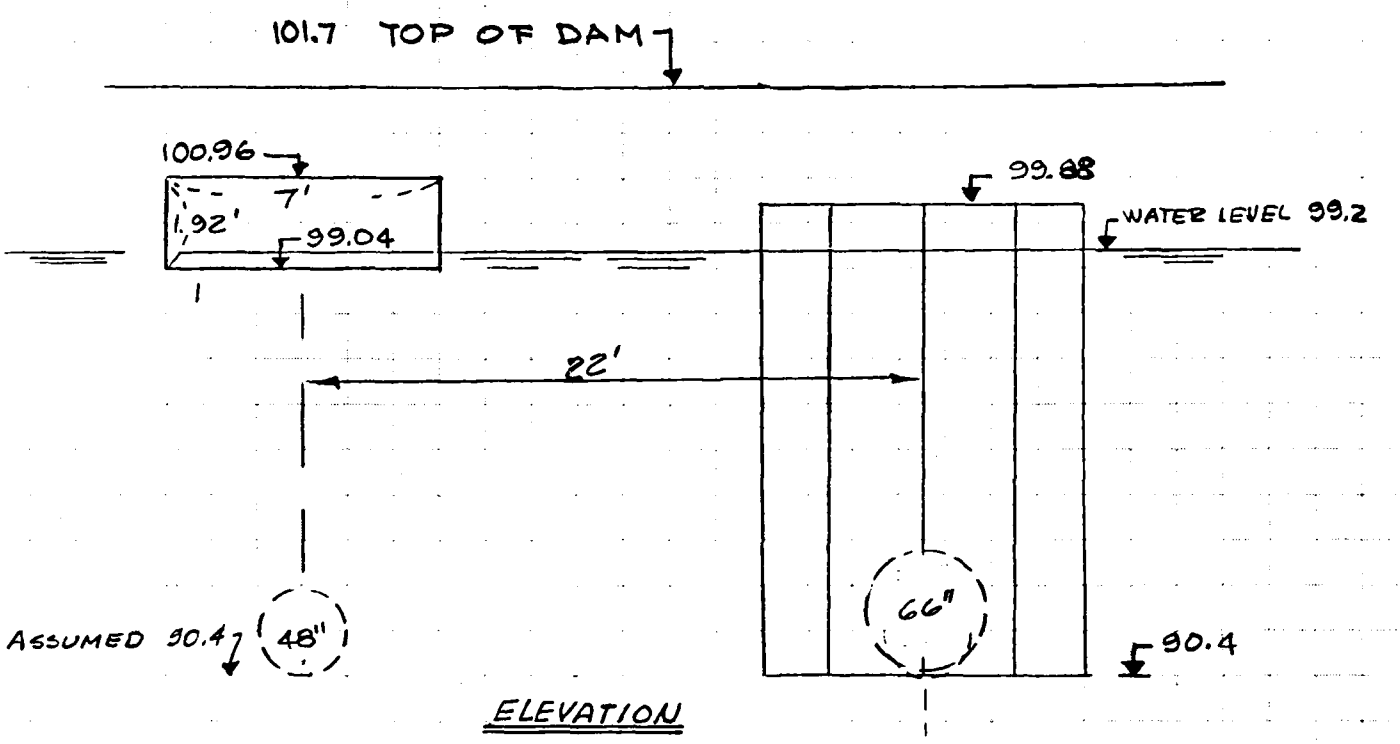

ROSEMARY LAKE DAM
FLOOD IMPACT AREA
CENTROID OF DRAINAGE BASIN
BASIN DIVIDE
Needham Heights
Needham
Needham Junction
Needham Reservoir
Charles River Village
Golf Course
Rosemary Lake
Rosemary Brook
Cricket Field
Hillside Sch
Carter Sch
Avery Sch
Mitchell Sch
High Sch
Highland Ave Sch
Newman Jr High Sch
Pollard Jr High Sch
Glover Memorial Hospital
High Rock Sch
Athletic Field
Fire Sta
Park
PENN CENTRAL
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

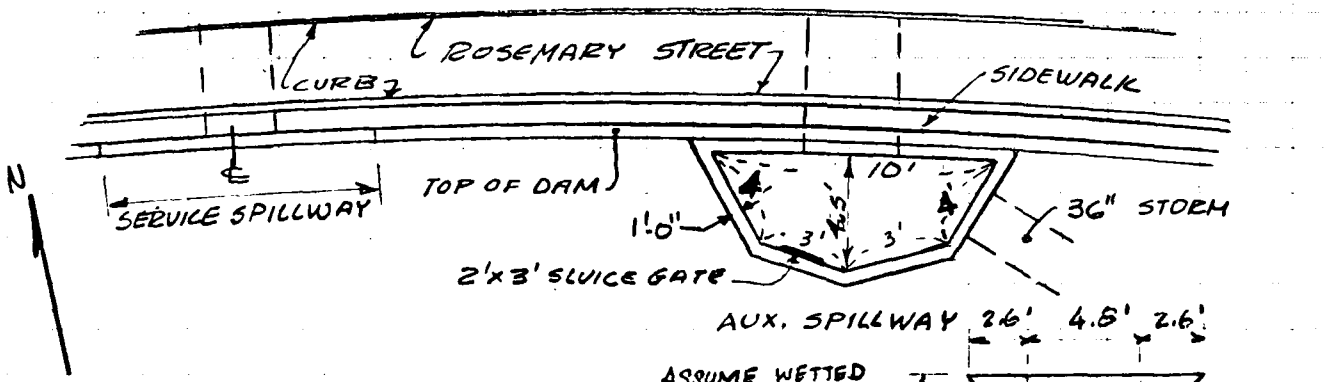
JOB NED-COE, ROSEMARY LAKE DAM
SHEET NO D-2 OF
CALCULATED BY RG DATE 10/30/79
CHECKED BY [illegible] DATE 12/5/79
SCALE

ROSEMARY LAKE DAM

DESCRIPTION OF SPILLWAYS

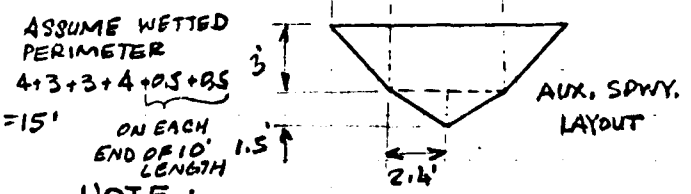


ELEVATION



N

PLAN



NOTE :
AUXILLIARY SPILLWAY OUTLET CONDUIT IS 48" IN DIAMETER @ DOWNSTREAM END

D-2

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB NED-COE, ROSEMARY LAKE DAM
SHEET NO. D-3 OF
CALCULATED BY RG DATE 10/30/79
CHECKED BY [illegible] DATE 12/5/79
SCALE

ROSEMARY LAKE DAM

DRAINAGE AREA = 1.23 Sq Mi

$C_t = 2.0$ $C_p = 0.5$

T_p COMPS.

$L = 2.2$ Miles ; $L_{ca} = 1.5$ Miles

$$T_p = C_t (L \times L_{ca})^{0.3}$$

$$T_p = 2.0 \times (2.2 \times 1.5)^{.3} \simeq \underline{3.00 \text{ Hours}}$$

PMP DATA

FROM HMS # 33 THE 24 HOUR 200 Sq Mi INDEX RAINFALL IS 21.5"

Gh % OF INDEX FOR THIS BASIN = 111%
= 124
= 133

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB NED-COE, ROSEMARY LAKE DAM
SHEET NO. D-4 OF
CALCULATED BY RG DATE OCT. 30 1979
CHECKED BY [signature] DATE 12/5/79
SCALE

ROSEMARY LAKE DAM

STAGE DISCHARGE

H=0 @ SPILLWAY CREST (ELEV: 99.04) Q_1
AUX SPILLWAY (ELEV: 99.88) Q_2
C = 2.28 FOR BROAD CRESTED WEIR
C = 0.65 FOR ORIFICE Q_1
C = 0.67 FOR ORIFICE Q_2

Q_1 FOR H = 0 $Q_1 = 0$
FOR $0 < H < 1.92$ $Q_1 = 2.8 \times 7 \times H^{3/2}$
FOR $H > 1.92$ $Q_1 = 0.65 \times 13.44 \times \sqrt{2g}\,(H-0.96)^{1/2}$ (ORIFICE)

Q_2 [1] FOR $H < 0.84$ $Q_2 = 0$
FOR $0.84 < H < 2.24$ $Q_2 = 3.0 \times P (H-0.84)^{3/2}$ $P \approx 15'$ P: WETTED PERIMETER
FOR $H > 2.24$ $Q_2 = 5.37 \times A (H-0.84)^{1/2}$ A: OP. AREA (ORIFICE)
$A \approx 26$ FT^2

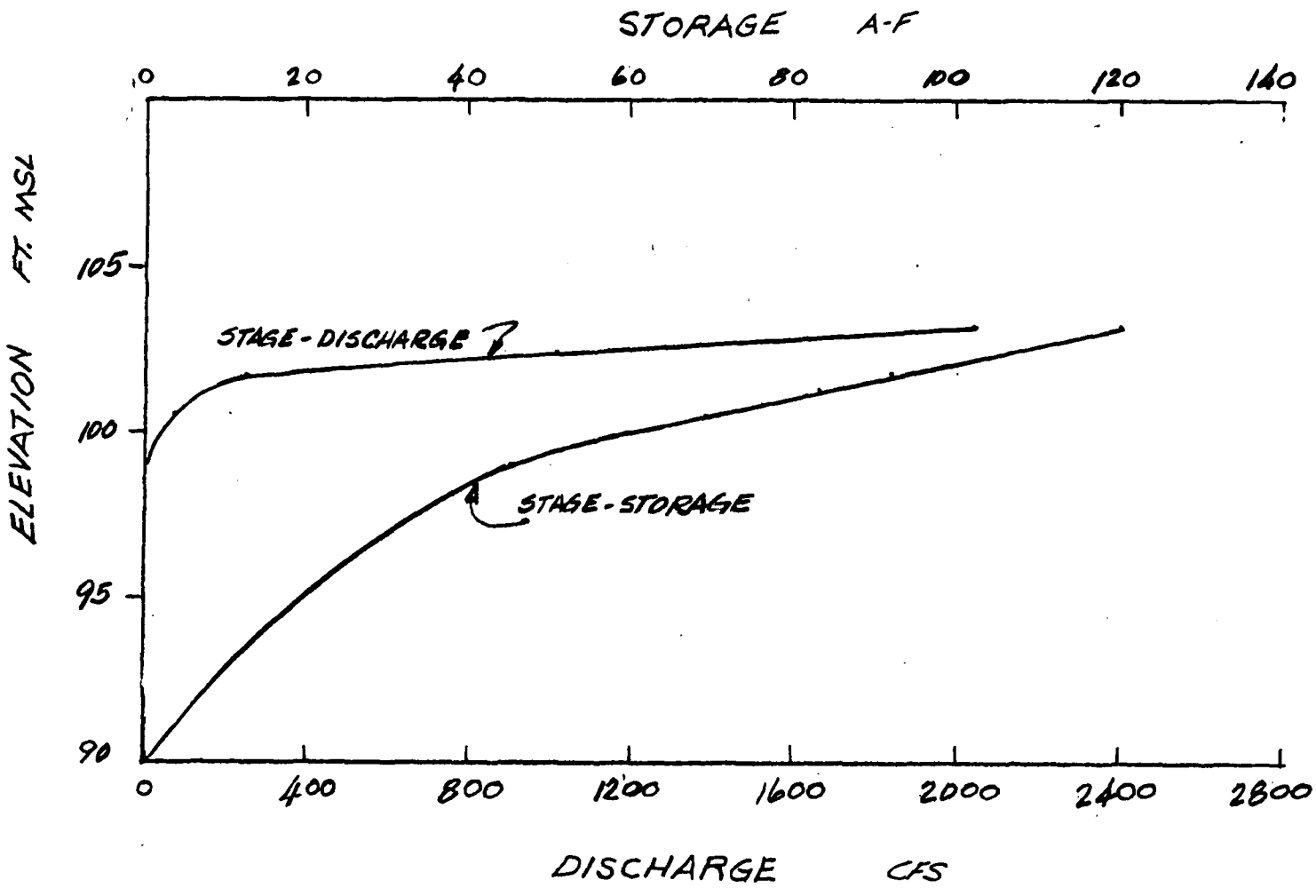
[1] REFER TO PAGES 12-26 & 12-27, U.S. DOT, FED. HIGHWAY ADMIN. HYDRAULIC ENG'R. CIRCULAR #12

ELEVATION USC&GS	H FT.	SERVICE SPILLWAY Q_1: CFS	AUX SPILLWAY Q_2: CFS	AVE WIDTH FLOW OVER DAM	TOP OF DAM Q_3: CFS	Σ Q CFS
99.04	0	0	0		0	0
100.04	1	19.6	3		0	23
101.04	2	71.5	56		0	128
102.04	3	100.1	205	277	155	460
103.04	4	122.2	248	322	1400	1770
104.04	5	140.9	285	349	3500	≈3930
105.04	6	157.4	317	378	6460	≈6930
106.04	7	172.3	346	405	10250	≈10770
107.04	8	186.0	374	450	15550	≈16110

ORIFICE CONTROL (Q1 and Q2)

STAGE - STORAGE

ELEV.	AREA	STORAGE (Computed by HEC-1 program)
90	0	0
99	15	45
110	35	120 @ ELEV 103.13



ROSEMARY LAKE DAM

STAGE VS. STORAGE

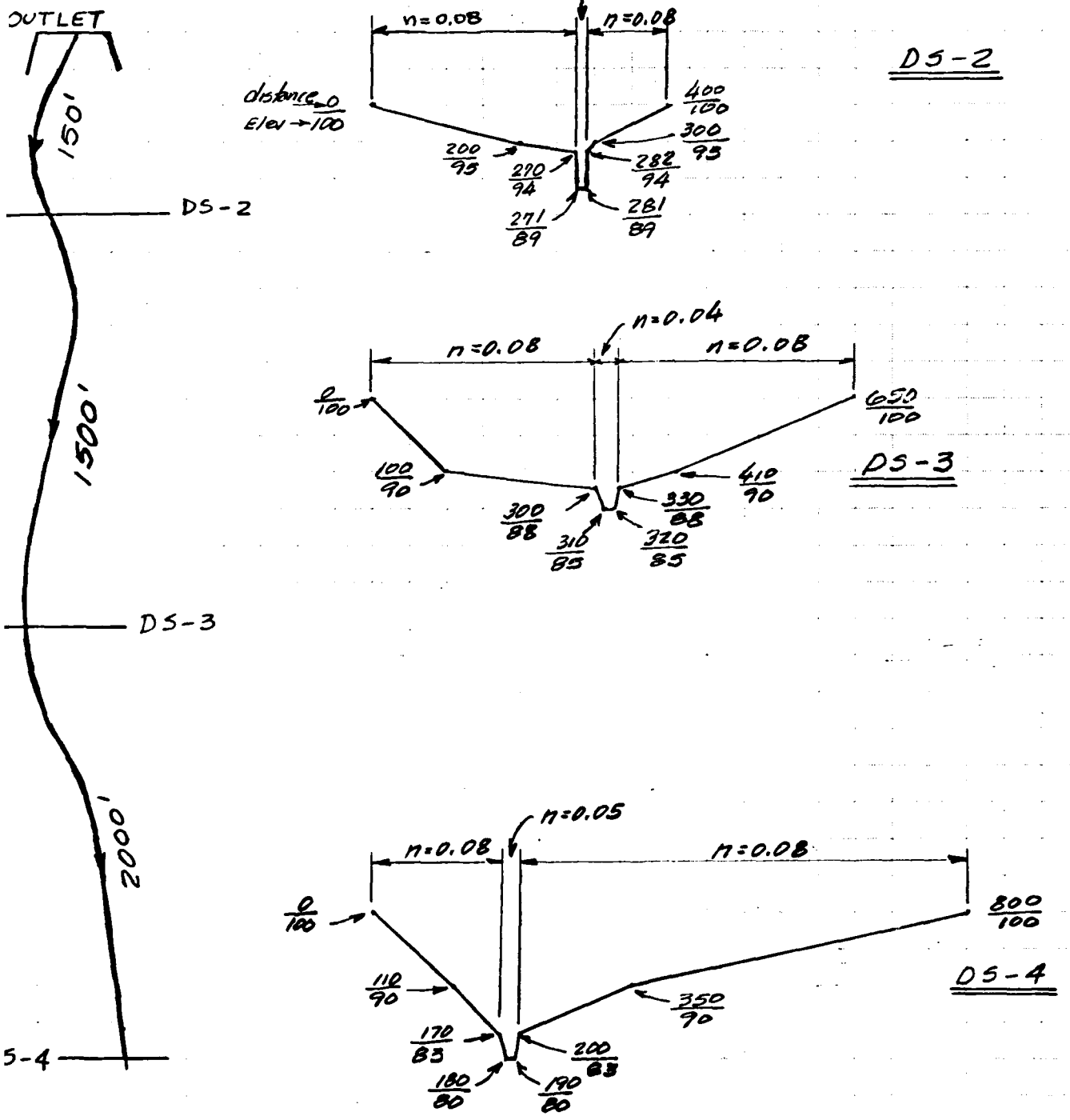
STAGE VS. DISCHARGE

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB NED-COE, ROSEMARY LAKE DAM
SHEET NO. D-6 OF
CALCULATED BY RG DATE 10/30/79
CHECKED BY [illegible] DATE 12/5/79
SCALE

ROSEMARY LAKE DAM
DOWNSTREAM X SECTIONS

DAM S-1



D-6

FLOODS ROUTED THROUGH ROSEMARY LAKE DAM WITHOUT BREACHING

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
```

INPUT

```
    1          A
    2          A
    3          A
    4          R    300       0      10       0       0       0       0       0      -4       0
    5          R1     5
    6          J      1       9       1
    7          J1   .05      .1     .15      .2      .25      .3      .5      .75     1.0
    8          K       ROSEMARY                                          1
    9          K1      INFLOW TO ROSEMARY LAKE
   10          M      1       1   1.23                                                    1
   11          P      0    21.5     111     124     133
   12          T                                                        0      .05
   13          W    3.0     0.5
   14          X   -1.7    -.05       2
   15          K      1    DAM-1                                        1
   16          K1      ROUTED OUTFLOW OF ROSEMARY LAKE
   17          Y                                 1       1
   18          Y1     1                                                -99      -1
   19          Y4    99     100     101   101.7     102     103     104     105     106     107
   20          Y5     0    23.0     128     247     460    1770    3930    6930   10770   16110
   21          $A     0      15      35
   22          $$    90      99     110
   23          $$    99
   24          $D 101.7
   25          K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT      SEMARY
ROUTE HYDROGRAPH TO       DAM-I
END OF NETWORK
```

DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATED 02/11/80.
TIME 0 13.12.08.

HYDROLOGIC ANALYSIS OF ROSEMARY LAKE DAM
NATIONAL DAM SAFETY PROGRAM
NEW ENGLAND DIVISION - CORPS OF ENGINEERS

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	-6	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

PERCENTAGES OF PMF USED → RTIOS= .05 .10 .15 .20 .25 .30 .50 .75 1.00

.50 → TEST FLOOD

INFLOW HYDROGRAPH DEVELOPMENT

SUB-AREA RUNOFF COMPUTATION

INFLOW TO ROSEMARY LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SEMARY	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.23	0.00	1.23	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 3.00 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.70 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 2.99 HOURS, CP= .50 VOL= .98

2.	6.	13.	21.	30.	40.	51.	62.	73.	85.
97.	107.	115.	123.	129.	133.	136.	137.	136.	132.
126.	121.	116.	112.	107.	103.	99.	95.	91.	87.
84.	80.	77.	74.	71.	68.	65.	63.	60.	58.
55.	53.	51.	49.	47.	45.	43.	42.	40.	38.

SUM 22.HR 21.6M 1.20 10124
(581.)(551.)(30.)(2866.

HYDROGRAPH ROUTING

ROUTED OUTFLOW OF ROSEMARY LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM-I	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-99.	-1

STAGE-DISCHARGE DATA

STAGE	99.00	100.00	101.00	101.70	102.00	103.00	104.00	105.00	106.00	107.00
FLOW	0.00	23.00	128.00	247.00	460.00	1770.00	3930.00	6930.00	10770.00	16110.00

STAGE-STORAGE DATA

SURFACE AREA=	0.	15.	35.
CAPACITY=	0.	45.	312.
ELEVATION=	90.	99.	110.

SPILLWAY CREST ELEVATION → 99.0

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
99.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOP OF DAM ELEVATION → 101.7

TOPEL	COQD	EXPD	DAMWID
101.7	0.0	0.0	0.

ROUTED OUTFLOWS

.05 PMF → PEAK OUTFLOW IS 74. AT TIME 20.83 HOURS

.10 PMF → PEAK OUTFLOW IS 171. AT TIME 20.17 HOURS

.15 PMF → PEAK OUTFLOW IS 284. AT TIME 19.50 HOURS

.20 PMF → PEAK OUTFLOW IS 401. AT TIME 19.00 HOURS

.25 PMF → PEAK OUTFLOW IS 509. AT TIME 18.83 HOURS

.30 PMF → PEAK OUTFLOW IS 611. AT TIME 18.83 HOURS

TEST FLOOD → .50 PMF → PEAK OUTFLOW IS 1018. AT TIME 18.83 HOURS

.75 PMF → PEAK OUTFLOW IS 1526. AT TIME 18.83 HOURS

1.0 PMF → PEAK OUTFLOW IS 2041. AT TIME 18.67 HOURS

D-9

FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .05	RATIO 2 .10	RATIOS APPLIED TO FLOWS RATIO 3 .15	RATIO 4 .20	RATIO 5 .25	RATIO 6 .30	RATIO 7 .50	RATIO 8 .75	RATIO 9 1.00
PEAK INFLOWS: HYDROGRAPH AT	SEMARY	1.23	1	102.	204.	307.	409.	511.	613.	1022.	1533.	2044.
		(3.19)		(2.89)	(5.79)	(8.68)	(11.58)	(14.47)	(17.37)	(28.95)	(43.42)	(57.89)
ROUTED OUTFLOWS: ROUTED TO	DAM-1	1.23	1	76.	171.	284.	401.	509.	611.	1018.	1526.	2041.
		(3.19)		(2.15)	(4.85)	(8.04)	(11.34)	(14.40)	(17.29)	(28.82)	(43.21)	(57.78)

RESULTS OF VARIOUS FLOODS AT ROSEMARY LAKE DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	99.00	99.00	101.70
STORAGE	45.	45.	91.
OUTFLOW	0.	0.	247. → SPILLWAY DISCHARGE CAPACITY

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	100.50	0.00	69.	76.	0.00	20.83	0.00
.10	101.25	0.00	83.	171.	0.00	20.17	0.00
.15	101.75	.05	92.	284.	1.83	19.50	0.00
.20	101.92	.22	95.	401.	4.33	19.00	0.00
.25	102.04	.34	98.	509.	5.83	18.83	0.00
.30	102.12	.42	99.	611.	7.00	18.83	0.00
.50	102.43	.73	105.	1018.	10.33	18.83	0.00
.75	102.81	1.11	113.	1526.	13.00	18.83	0.00
1.00	103.13	1.43	120.	2041.	14.83	18.67	0.00

→ TEST FLOOD ELEVATION

→ ROUTED TEST FLOOD OUTFLOW

```
 4          B    300       0      10       0       0       0       0       0      -4       0
 5          B1     5
 6          J      1       1       1
 7          J1     0
 8          K      1    DAM-1                                                  1
 9          K1                 ROUTED OUTFLOW OF ROSEMARY LAKE
10          Y                                      1       1
11          Y1    -1                                                      -101.7      -1
12          Y4    99     100     101    101.7     102     103     104     105     106     107
13          Y5     0    23.0     128     247     460    1770    3930    6930   10770   16110
14          $A     0      15      35
15          $E    90      99     110
16          $$    99
17          $D  101.7
18          $R    44    0.01    93.0       1   101.7   101.7
19          K      1    DS-2                                                   1
20          K1                 CHANNEL ROUTING REACH 1-2
21          Y                                      1       1
22          Y1     1                                                      -1
23          Y6  0.08    0.03    0.08      89     100     150   0.007
24          Y7     0     100     200      95     270      94     271      89     281      89
25          Y7   282      94     300      95     400     100
26          K      1    DS-3                                                   1
27          K1                 CHANNEL ROUTING REACH 2-3
28          Y                                      1       1
29          Y1     1                                                      -1
30          Y6  0.08    0.04    0.08      85     100    1500    .003
31          Y7     0     100     100      90     300      88     310      85     320      85
32          Y7   330      88     410      90     650     100
33          K      1    DS-4                                                   1
34          K1                 CHANNEL ROUTING REACH 3-4
35          Y                                      1       1
36          Y1     1                                                      -1
37          Y6  0.08    0.05    0.08      80     100    2000   .0025
38          Y7     0     100     110      90     170      83     180      80     190      80
39          Y7   200      83     350      90     800     100
40          K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
ROUTE HYDROGRAPH TO        DAM-1
ROUTE HYDROGRAPH TO         DS-2
ROUTE HYDROGRAPH TO         DS-3
ROUTE HYDROGRAPH TO         DS-4
END OF NETWORK
```

HYDROLOGIC ANALYSIS OF ROSEMARY LAKE DAM
NATIONAL DAM SAFETY PROGRAM
NEW ENGLAND DIVISION - CORPS OF ENGINEERS

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	-4	0

JOPER	NWT	IROPT	ITRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

NO INFLOW → RTIOS= 0.00

HYDROGRAPH-ROUTING

ROUTED OUTFLOW OF ROSEMARY LAKE

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	DAM-I	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-102.	-1

STAGE - DISCHARGE DATA

STAGE	99.00	100.00	101.00	101.70	102.00	103.00	104.00	105.00	106.00	107.00
FLOW	0.00	23.00	128.00	247.00	460.00	1770.00	3930.00	6930.00	10770.00	16110.00

STAGE-STORAGE DATA

SURFACE AREA=	0.	15.	35.
CAPACITY=	0.	45.	312.
ELEVATION=	90.	99.	110.

SPILLWAY CREST ELEVATION →

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
99.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
TOP OF DAM ELEVATION → 101.7	0.0	0.0	0.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
44.	.01	93.00	1.00	101.70	101.70

BREACH DATA - FAILURE BEGINS IMMEDIATELY WITH RESERVOIR SURFACE AT TOP OF DAM

BEGIN DAM FAILURE AT 0.00 HOURS

PEAK OUTFLOW IS 1239. AT TIME .94 HOURS

→ PEAK BREACH DISCHARGE

0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	ELWTH	SEL
.0400	.0300	.0800	89.0	100.0	150.	.00700

} CHANNEL CHARACTERISTICS AT FIRST DOWNSTREAM DAMAGE AREA

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 100.00 200.00 95.00 270.00 94.00 271.00 89.00 281.00 89.00
282.00 94.00 300.00 95.00 400.00 100.00

} CROSS-SECTION OF DOWNSTREAM CHANNEL AT FIRST DAMAGE AREA

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL AT THE FIRST DAMAGE AREA

STORAGE	0.00	.02	.04	.06	.08	.11	.13	.15	.17	.20
	.32	.52	.80	1.15	1.57	2.05	2.61	3.23	3.92	4.69
OUTFLOW	0.00	15.81	47.85	90.18	140.35	196.95	259.10	326.21	397.85	480.98
	603.81	790.72	1055.39	1407.32	1857.96	2418.25	3098.71	3909.40	4860.02	5959.94
STAGE	89.00	89.58	90.16	90.74	91.32	91.89	92.47	93.05	93.63	94.21
	94.79	95.37	95.95	96.53	97.11	97.68	98.26	98.84	99.42	100.00
FLOW	0.00	15.81	47.85	90.18	140.35	196.95	259.10	326.21	397.85	480.98
	603.81	790.72	1055.39	1407.32	1857.96	2418.25	3098.71	3909.40	4860.02	5959.94

MAXIMUM STAGE IS 96.2

→ STREAM ELEVATION AT FIRST DAMAGE AREA

HYDROGRAPH ROUTING

SECOND DOWNSTREAM REACH → CHANNEL ROUTING REACH 2-3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	85.0	100.0	1500.	.00300

} CHANNEL CHARACTERISTICS AT SECOND DOWNSTREAM DAMAGE AREA

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 100.00 100.00 90.00 300.00 88.00 310.00 85.00 320.00 85.00
330.00 88.00 410.00 90.00 650.00 100.00

} CROSS-SECTION OF DOWNSTREAM CHANNEL AT SECOND DAMAGE AREA

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL AT THE SECOND DAMAGE AREA

STORAGE	0.00	.34	.83	1.46	2.29	5.21	11.13	19.55	28.83	38.84
	49.58	61.05	73.25	86.17	99.83	114.22	129.33	145.18	161.76	179.06
OUTFLOW	0.00	15.17	53.91	118.30	216.67	402.71	736.33	1308.93	2105.65	3098.93
	4286.61	5669.44	7249.77	9030.88	11016.64	13211.34	15619.55	18246.00	21095.56	24173.22
STAGE	85.00	85.74	86.58	87.37	88.16	88.95	89.74	90.53	91.32	92.11
	92.89	93.68	94.47	95.26	96.05	96.84	97.63	98.42	99.21	100.00
FLOW	0.00	15.17	53.91	118.30	216.67	402.71	736.33	1308.93	2105.65	3098.93
	4286.61	5669.44	7249.77	9030.88	11016.64	13211.34	15619.55	18246.00	21095.56	24173.22

MAXIMUM STAGE IS 90.3 → STREAM ELEVATION AT SECOND DAMAGE AREA

********** *********** ********** ********* **********

HYDROGRAPH ROUTING

THIRD DOWNSTREAM REACH → CHANNEL ROUTING REACH 3-4

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0500	.0800	80.0	100.0	2000.	.00250

} CHANNEL CHARACTERISTICS AT THIRD DOWNSTREAM DAMAGE AREA

CROSS-SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 100.00 110.00 90.00 170.00 83.00 180.00 80.00 190.00 80.00
200.00 83.00 350.00 90.00 800.00 100.00

} CROSS-SECTION OF DOWNSTREAM CHANNEL AT THIRD DAMAGE AREA

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL AT THE THIRD DAMAGE AREA

STORAGE	0.00	.65	1.64	2.99	5.43	9.40	14.89	21.91	30.46	40.53
	52.30	66.75	84.04	104.19	127.19	153.03	181.72	213.26	247.65	284.89
OUTFLOW	0.00	18.57	68.49	158.06	320.98	569.01	924.67	1407.30	2034.57	2822.92
	3728.11	4815.05	6179.99	7848.41	9847.25	12203.39	14943.15	18092.18	21675.44	25717.25
STAGE	80.00	81.05	82.11	83.16	84.21	85.26	86.32	87.37	88.42	89.47
	90.53	91.58	92.63	93.68	94.74	95.79	96.84	97.89	98.95	100.00
FLOW	0.00	18.57	68.49	158.06	320.98	569.01	924.67	1407.30	2034.57	2822.92
	3728.11	4815.05	6179.99	7848.41	9847.25	12203.39	14943.15	18092.18	21675.44	25717.25

MAXIMUM STAGE IS 86.6 → STREAM ELEVATION AT THIRD DAMAGE AREA

********** *********** ********** ********* **********

ROSEMARY LAKE DAM
BREACH OUTFLOW

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	101.70	99.00	101.70
STORAGE	91.	45.	91.
OUTFLOW	247.	0.	247.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	101.68	0.00	91.	1239.	0.00	.94	0.00

1239. → PEAK BREACH OUTFLOW

FIRST DOWNSTREAM DAMAGE AREA → PLAN 1 STATION DS-2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	1225.	96.2	1.00

96.2 → STREAM ELEVATION AT FIRST DAMAGE AREA

SECOND DOWNSTREAM DAMAGE AREA → PLAN 1 STATION DS-3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	1132.	90.3	1.00

90.3 → STREAM ELEVATION AT SECOND DAMAGE AREA

THIRD DOWNSTREAM DAMAGE AREA → PLAN 1 STATION DS-4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	1035.	86.6	1.17

86.6 → STREAM ELEVATION AT THIRD DAMAGE AREA

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(8) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
MA	1112	NED	MA	021	09				ROSEMARY LAKE DAM	4217.2	7114.4	04	JAN	80

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	ROSEMARY LAKE

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	06	ROSEMARY BROOK	NEEDHAM	0	29750

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REOTPG	1800	R	12	12	91	45	NED	N	N	N	N	

(28) REMARKS
STONE MAS FACE WALL , ESTIMATED CONST DATE 1920 YR BUILT EST FROM RCDS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	440	U	22	247	18000											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
TOWN OF NEEDHAM	UNKNOWN	UNKNOWN

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	MA DEQE	MA DEQE

(50) INSPECTION BY	(51) INSPECTION DATE DAY	MO	YR	(52) AUTHORITY FOR INSPECTION
O'BRIEN + GERE ENGINEERS INC.	16	OCT	79	PL 92-367

(53) REMARKS
AUX SPILLWAY EL APPROX 1 FT HIGHER THAN SERVICE SPILLWAY

END

FILMED

8-85

DTIC